United States Court of Appeals

for the Second Circuit

APPELLANT'S BRIEF

74-1629-1632

United States Court of Appeals

FOR THE SECOND CIRCUIT

Nos. 74-1629 & 74-1632

B P/s

HELLENIC LINES LIMITED,
Plaintiff-Appellant,

—against—

LIFE INSURANCE CORPORATION OF INDIA,
Defendant-Appellee.

HELLENIC LINES LIMITED,
Plaintiff-Appellant,

—against—

AETNA CASUALTY & SURETY COMPANY, *et al.*,
Defendants-Appellees.

ON APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE SOUTHERN DISTRICT OF NEW YORK

BRIEF FOR PLAINTIFF-APPELLANT HELLENIC LINES LIMITED

BURLINGHAM UNDERWOOD & LORD
25 Broadway
New York, New York 10004
Attorneys for Plaintiff-Appellant
Hellenic Lines Limited

HERVEY C. ALLEN
JOHN S. ROGERS
ALEXANDER S. KRITZALIS
Of Counsel

INDEX

Table of Authorities

United States Court of Appeals

FOR THE SECOND CIRCUIT

Nos. 74-1629 & 74-1632

HELLENIC LINES LIMITED,

Plaintiff-Appellant,

—against—

LIFE INSURANCE CORPORATION OF INDIA,

Defendant-Appellee.

HELLENIC LINES LIMITED,

Plaintiff-Appellant,

—against—

AETNA CASUALTY & SURETY COMPANY, *et al.*,

Defendants-Appellees.

ON APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE SOUTHERN DISTRICT OF NEW YORK

BRIEF FOR PLAINTIFF-APPELLANT HELLENIC LINES LIMITED

Preliminary Statement

Plaintiff Hellenic Lines Limited (hereinafter "Hellenic") appeals from two judgments (760a-761a; 764a) of the District Court, Southern District of New York, in consolidated suits, after trial of this admiralty and maritime claim before the Honorable Thomas P. Griesa.

The decision below was dictated from the bench on February 7, 1974 following eight days of trial (582a-608a), and is not reported.

Hellenic, a Greek carrier, seeks recovery from defendants, marine insurers of cargo (hereinafter "Cargo Underwriters"), as guarantors, of approximately $135,000 in contributions in general average due from cargo carried aboard the motor vessel HELLENIC SAILOR on a voyage from U.S. Gulf and East Coast ports to Red Sea and Indian ports.

The contributions are cargo's share of extraordinary expenses for completion of the voyage following a fracture of the vessel's crankshaft which occurred suddenly during the early morning hours of December 24, 1967, some thirty-six days after the vessel departed New York, her last port of loading, and as she approached Jeddah, her first port of discharge.

The Court held that Hellenic failed to sustain its burden of proving that it exercised due diligence with respect to the crankshaft before and at the beginning of the voyage, within the meaning of Section 3(1) of the Carriage of Goods by Sea Act [46 U.S.C. §1303(1)] and dismissed the complaints.

Issues Presented for Review

1. Did the trial court commit reversible error in disregarding physical evidence that since crankshaft alignment and the condition of the bearings were satisfactory following the casualty, they were acceptable at and before the commencement of the voyage, and in holding that the absence of additional tests prior to commencement of the voyage constituted a want of due diligence?

2. Did the trial court commit reversible error in finding that web deflection readings are taken other than as a

measure of crankshaft alignment, and that the absence of such readings therefore constituted a want of due diligence?

3. Did the trial court commit reversible error in failing to hold that the casualty to the crankshaft of the HELLENIC SAILOR was caused by a latent defect not discoverable by due diligence?

Statement of the Case

Summary

The error of the Court below is in application of certain physical as well as legal principles.

In summary, a significant operational consideration in respect of a marine diesel engine crankshaft is "alignment", i.e., whether the bearings are evenly supporting the crankshaft. When the bearings, which are the sole support of the shaft, are in proper condition, the crankshaft is evenly aligned (in terms of a horizontal plane).

Of three generally accepted means of measuring "alignment" (i.e., the position of the shaft as a function of the condition of the bearings), two are generally utilized in respect of the Sun-Doxford type of engine which is the subject of this case.

The Court below draws an adverse inference against shipowner because the results of one such test (wire gauge), taken at the port preceding the last port of loading for the voyage in question, were not available. But that test, if its results *were* known, would only constitute an indication of the condition of the bearings, and this condition was shown, by a test conducted after the casualty, to be in all respects proper.

In short, any inference of lack of due diligence was, at the least, overcome by evidence of the actual condition in respect of which the test was or should have been conducted.

Secondly, the Court takes another test for the same *alignment* condition—"web deflection" measurements—and, because the fracture in question happened to occur in a *web* segment of the crankshaft, finds that there is an inference of lack of due diligence because of shipowner's failure to produce evidence of the results of "web deflection" readings which were made from time to time by the crew.

In so finding, the Court misunderstood the unanimous testimony of all witnesses to the effect that "web deflection" measurements are simply a function of, and another indication of, *alignment* (which in turn is a function of the condition of the bearings), and that such tests are not utilized on Sun-Doxford engines since the greater flexibility of the crankshaft (in the unique and specially designed spherical bearings of the Sun-Doxford) render the resulting greater range of web deflections non-indicative of the only condition under study: alignment of the shaft and condition of the bearings.

For this reason, more precise and reliable methods of determining alignment are utilized on Sun-Doxfords (e.g., wire gauge readings), and web deflection tests are not relied upon, although they may be taken from time to time as another albeit less reliable test of possible misalignment. In fact, and once again, the actual proof in this case of the acceptability of the actual condition which the "web deflection" test is used to determine—shaft alignment and condition of the supporting bearings—overcomes any adverse inference that might arise by reason of the absence of the results of occasional web deflection measurements.

Description of HELLENIC SAILOR's Doxford engine.

The crankshaft is the foremost part of a motor vessel's drive shaft. It converts the power generated by the pistons into rotating motion of the crankshaft which is transmitted through the intermediate shafting to the tailshaft and turns the propeller.

Any crankshaft consists of journals, webs and pins. A journal is the cylindrical portion of a shaft which lies on a horizontal axis in a bearing and rotates. A web is an arm fixed at a right angle to the journal by which motion is imparted to the journal. A crankpin is a cylindrical member fixed at a right angle to the web, parallel to the journal's horizontal axis. The reciprocating motion of the piston is transmitted to the crankshaft by a rod connected at the crankpin, and causes the journal to rotate. The HELLENIC SAILOR's crankshaft consists of five journals, sixteen webs, and twelve pins (Ex. 1B). The total length of the HELLENIC SAILOR's crankshaft is 44 feet. The total weight of the crankshaft is 120 tons (587a).

The HELLENIC SAILOR's crankshaft consists of four sections, one section serviced by each of the engine's four cylinders. Each of the five journals lies on a horizontal axis in a main bearing, numbered one through five from the forward part of the engine aft. Each shaft section, weighing 30 tons, consists of four webs—two large center webs joined by a center crankpin, and two side webs. Each side web is fixed to the adjacent large web by a side crankpin. As shown on Exhibit 1B, a schematic diagram designed as an aid to the District Court, the No. 1 shaft section lies in the Nos. 1 and 2 bearings and is attached or flanged to the No. 2 section just aft of the No. 2 bearing. The after end of the No. 2 section, the No. 3 journal, lies in the No. 3 bearing and is flanged to the No. 3 shaft section just aft of the

No. 3 bearing. The after end of the No. 3 section, the No. 4 journal, lies in the No. 4 bearing. It is flanged to the No. 4 section just aft of the No. 4 bearing. The after end of the No. 4 section, the No. 5 journal, lies in the No. 5 bearing. The crankshaft is depicted in profile by Exhibit 6 and, unlike Exhibit 1B, shows the actual configuration of the crankshaft in the vessel due to the differing firing order in the cylinders.

The web which fractured is the No. 2 after side web, just forward of the No. 3 journal. Its dimensions were 6 feet by 4 feet by 1 foot (589a; see Exh. 7P).

The after end of the No. 4 shaft section is connected through the thrust bearing to the intermediate shaft. The intermediate shaft which consists of four straight sections in the same horizontal axis as the crankshaft lies in the shaft alley, on bearings, and at its after end is connected to the tailshaft.

Each cylinder on the HELLENIC SAILOR'S opposed-piston engine has as two pistons, upper and lower. The lower piston is connected to the crankshaft by a rod attached to the center crankpin. The upper piston is connected to the crankshaft by two side connecting rods, one attached to the forward side crankpin and the other attached to the after side crankpin. Combustion takes place in the cylinder between the top of the lower piston and the bottom of the upper piston. When combustion forces the pistons in opposite directions the connecting rods turn each crank section and convert the opposed action of the pistons into rotating motion of the journals as they lie on the main bearings. This is transmitted through the intermediate shafting to the tailshaft and turns the propeller.

Each of the five journals on the HELLENIC SAILOR'S crankshaft is approximately 2 feet in diameter and rests in a main bearing. To accommodate the great size and flexibil-

ity of a Doxford crankshaft, every Doxford is designed with spherical or "self-aligning" main bearings (280a; 156a-157a; 330a). Each spherical bearing consists of a lower half and an upper half. The lower half is set in a vertical entablature or side wall in the crankcase (Exs. 5; 7O). The upper half is retained by a cover and four large bolts (Exs. 7Q; 7S). The surface of each half of the bearing which comes into contact with the crankshaft journal is lined with a soft, anti-friction metal called "babbit" or "white metal" (140a-142a; 163a). The bearing halves are bored to accommodate the diameter of the journal.

The lower radius of the journal sits in the bore or radius of the lower half of the bearing, which is housed, but not fixed, in the entablature. The clearance between the crankshaft journal and the upper half of the bearing is the lubricating clearance which allows rotation. The clearance between the top half of the bearing and the bearing cover is the spherical clearance which allows the bearing to move and permits the crankshaft journal to tilt as it rotates.

Crankshaft Alignment.

Crankshaft alignment is a phrase used to describe how the crankshaft sits or rests on the main bearings.

One of the two factors affecting crankshaft alignment is the flexibility of the crankshaft itself (282a; 340a-341a). In the more common type of 4-cylinder diesel engine with one piston per cylinder, its crankshaft has only one crank pin per cylinder. As a rough guide, 95 to 98 per cent of all marine diesel engines have one piston per cylinder, shorter distance between main bearings and therefore "stiff" crankshafts, and main bearings that are fixed, rather than spherical (153a; 157a; 283a; 430a). But in a 4-cylinder Doxford

double-opposed piston engine, like the HELLENIC SAILOR'S, the crankshaft has three crank pins and four webs per shaft section. As a result, a Doxford crankshaft is greater in size and flexibility, hence the unique design feature of spherical main bearings.

The other factor affecting crankshaft alignment is the condition of the spherical bearings. Wear-down of the babbit of the lower halves of the main bearings creates deflection of the crankshaft (328a; 332a; 339a-340a). The greater the wear-down of the bearings, the greater the deflection, or sag, of the crankshaft from a true horizontal. Also, the greater the sag, the greater the deflection of all the crank webs from a true right angle (451a). When an engine is in operation the most desirable condition is a perfectly straight crankshaft. On a Doxford engine this is never possible due to the shaft's great size and flexibility (189a-190a; 231a). The crank webs are therefore always "fluctuating" or deflecting to some extent (361a-362a). The purpose of minimizing sag, or hog, in the crankshaft is to minimize deflection of the webs, and thereby minimize the stresses on the webs due to their deflection (451a).

The only way to reduce sag or hog, i.e., to correct misalignment, is to adjust the bearings. The bearings are removed from the vessel to shoreside machine shops where the old babbit metal is melted out and the bearings are "rebabbitted" and machined to the appropriate bore (175a; 210a-211a; 274a; 328a; 346a).

The recognized method for measuring crankshaft alignment on a Sun-Doxford engine is the wire gauge method. It is the only method used by Sun Shipbuilding (331a; 349a). It is the only method used by Golten Marine unless the vessel is completely dead, in which case the telescopic method (which is affected by vibration) can be used (276a; Tr. 418-424; 278a; 430a). The readings obtained by the

wire gauge indicate how the crankshaft is lying in the bearings within a thousandth of an inch (276a-278a), which is the thickness of a human hair (297a). Sag or hog, within limits, is an inevitable and accepted condition. If the wire gauge readings show an excessive sag or hog, then corrective measures are required by remetalling and remachining the bearings as described above.

Sun Shipbuilding never published regulations or recommendations with respect to maximum permissible sag or hog of Doxford crankshafts (327a). According to Smith (who personally supervised the manufacture of 32 crankshafts including the HELLENIC SAILOR's in his 43 years with Sun Shipbuilding (324a; 352a)), the reason Sun did not publish any tolerances was "[B]ecause it wasn't necessary. You have a crankshaft with spherical bearings, it will take care of reasonable hog or sag. Or misalignment would probably be the better explanation" (327a).

If the stresses on a crankshaft during its operation from misalignment are excessive, then during regular inspections inside the crankcase before and after extended voyages, the symptoms would be "heated bearings or possible babbit extrusion" which would be "visible at the time of inspection, and by feel" (163a; 351a). Heated bearings would be reflected in the temperature of the lube oil, and if babbit deposit were coming from the bearings into the oil it would be caught by the oil filter (206a; 351a).

Routine shipboard practice of Hellenic's Chief Engineers on all its motor vessels, not just the HELLENIC SAILOR and three other Doxford vessels operated by it (149a-151a; 198a; 210a), included entering the crankcase and visually inspecting the bearings for babbit extrusion (162a-164a). The internal inspections also include checking the lubricating and spherical clearances with a feeler gauge (171a-

172a), which, aside from measuring the clearances, measures wear-down, if any, of the main bearings (206a; 341a).

The most desirable condition of crankshaft alignment is to have the shaft perfectly straight, whether the engine is static or in operation (288a; 612a). In terms of the HELLENIC SAILOR wire alignment diagrams, e.g., Exh. 23, in such a condition each reading at each of the five bearings would be on the zero line. This is never possible on a Doxford engine (612a); the crankshaft must inevitably show some hog or sag (590a), and this, within limits, is acceptable 443a; 452a). In either a hog or sag, the most desirable condition is for the shaft to lie in a smooth, gradual curve over its entire length (298a; 310a; 312a-313a; 365a; 369a). The maximum radius of any such curve must, in the nature of things, be at the middle of the crankshaft, or at the No. 3 main bearing, which the Court pointed out is just aft of the web which fractured (592a). A dog-leg is a discontinuity in the curve caused by the shaft at one of the three middle bearings being substantially higher or lower than the others. If excessive, a dog-leg would cause excessive stresses to the crankshaft (474a).

A factor affecting shaft alignment is draft of the vessel. When the HELLENIC SAILOR was constructed in 1939, her engine was installed amidship in the widest and stiffest part of the vessel. Although Smith testified that Sun's experience with vessels of the HELLENIC SAILOR type showed no increase or decrease in crankshaft deflection with variance in draft (337a-339a; 366a-367a), Hellenic's witnesses, familiar with the HELLENIC SAILOR as she traded in Hellenic's service from 1956 until her sale in 1973 (150a), testified that when a Doxford vessel was light of cargo in the forward and after holds, the crankshaft would show a sag because the engine was in the heaviest part of the ship

(444a; 245a). As the vessel was loaded, the sag would decrease (442a). With the vessel in a fully loaded condition the crankshaft would show hog because of the weight in the forward and after holds (192a). The sag in a light condition and the hog in a loaded condition would be a compromise since the most desirable, or theoretical optimum, condition would be to maintain the crankshaft perfectly straight, irrespective of the cargo in the vessel (682a).

At any given draft, however, the HELLENIC SAILOR'S crankshaft, though properly aligned, could show either a hog or a sag, notwithstanding the vessel's draft. Allan testified that at a draft of 13 feet 6 inches forward and 22 feet 0 inches aft, a condition at which the crankshaft would be expected to show a sag, the crankshaft could also show a hog within 15 to 20 thousandths of an inch "depending on how the bearings were lying" (665a). If the HELLENIC SAILOR were in a loaded condition, where the shaft would normally be expected to show a hog, and the crankshaft showed a sag, there would be no cause for concern provided the sag was within limits (454a).

Smith testified that Sun, from its experience in ship repair, used a guideline that when the sag shown by the wire gauge method reached a maximum one-eighth of an inch (125 thousandths of an inch) Sun would recommend realignment (328a; 335a; 339a; 346a-349a; 382a). As the Court noted: "The question of how much sag or how much hog would be permitted was a matter for the sound judgment of the people responsible for the vessel" (596a-597a).

Haugestad, [Golten Marine's service engineer and trouble shooter for 15 of his 30 years with that company] who had been using the wire gauge method on Doxfords for 20 years (430a), testified the figures he uses are "just from experience—nothing in the books about it" (454a). He said that when the wire alignment readings showed a sag of 60

thousandths of an inch at No. 3 bearing, with the vessel in a light condition, he would take it up with Hellenic's port engineers to see if they wanted the shaft re-aligned. Although he still considered it safe to let the vessel sail, he would at least inquire further (453a). Haugestad was also of the opinion that if the HELLENIC SAILOR were in a loaded condition and the wire alignment readings showed a sag of 40 thousandths of an inch at No. 3 bearing, he would discuss the matter with Hellenic's port engineers (455a). Haugestad considered Sun Shipbuilding's guideline of 125 thousandths of an inch excessive, but he was of opinion that so long as maximum smooth sags of 60 thousandths of an inch in a light condition or 40 thousandths of an inch in a loaded condition were not exceeded, there would be no cause of concern.

In Allan's opinion the most significant factor when taking draft alignment readings by the wire gauge method, aside from the ship's draft, was the trim or the difference between the fore and aft draft (623a; 732a). Allan considered the fore and aft draft individually and not the mean draft. He considered that readings taken with the vessel close to an even keel, a two or three foot difference between fore and aft draft, would be "more reliable" and "more indicative of what would be required for correction" (684a).

On the other hand, Messrs. Golten [President of Golten Marine and founder of that Company in 1941 (274a)] and Petsis [Hellenic's assistant marine Superintendent from 1956 to 1970 and marine Superintendent at time of trial (127a)] were of opinion that the draft or trim of the vessel would have slight effect, if any, on an alignment reading (195a; 298a; 321a). In response to a direct question from the bench, however, Golten naturally agreed that, in ascertaining the possible existence of any alignment problem, two readings would be better than one (319a-320a).

HISTORICAL CHRONOLOGY

1939

HELLENIC SAILOR, a C-2 cargo liner, built and launched by Sun Shipbuilding & Drydock Company at Chester, Pennsylvania, as the MORMACWREN for Moore-McCormack Lines;

1954

Hellenic purchased the HELLENIC SAILOR from Belgian Line (164a; 689a).

Nov. 1960

The HELLENIC SAILOR's crankshaft required realignment which was accomplished at Genoa by remetalling and remachining the lower halves of the main bearings. Crankshaft alignment readings taken before repairs and after completion of repairs by wire gauge and by web deflection (620a; Ex. V).

Sept. 1962

Crankshaft required realignment which was accomplished at Piraeus by remetalling and remachining the bearings. Crankshaft alignment measured by Golten Marine, Inc. by wire gauge after completion of repairs; alignment also measured by web deflection after repair (Ex. E).

Oct.-Nov. 1962

HELLENIC SAILOR at Port Sudan. Main bearings were overheating because of microscopic pitting of the journals and 4 new lower halves installed at Nos. 2, 3, 4 and 5 bearings (626a-627a; 709a-710a; 722a; Ex. 62). There was no difficulty with the main bearings thereafter (719a-720a; 745a).

Nov. 20, 1963

Crankshaft alignment measured by Golten Marine at New York by wire gauge revealed satisfactory alignment (Ex. L).

Sept. 8, 1964

Crankshaft alignment measured by Golten Marine at New York by wire gauge revealed satisfactory alignment (Ex. M).

Feb. 1, 1966

Crankshaft alignment measured by Golten Marine at New York by wire gauge revealed satisfactory alignment (Ex. N).

Mar. 24, 1966

Lloyd's Register of Shipping surveyed part of vessel's machinery in connection with the classification society's continuous survey. The Nos. 2, 3, 4 and 5 crankshaft journals and main bearings were examined and found in order (Ex. 21).

Aug. 2, 1966

Crankshaft alignment measured by Golten Marine at New York by wire gauge revealed satisfactory alignment (Ex. P).

Sept. 13, 1967

HELLENIC SAILOR called at Durban. Internal inspection in crankcase revealed conditions satisfactory (204a-207a).

Oct. 5-7, 1967

HELLENIC SAILOR called at Savannah. Internal inspection in crankcase revealed conditions satisfactory (207a-208a).

Oct. 7-8, 1967

HELLENIC SAILOR called at Charleston.

Oct. 10, 1967

HELLENIC SAILOR arrived at New York.

Oct. 11, 1967

Crankshaft alignment measured by Golten Marine by wire gauge revealed satisfactory alignment (Ex. 23). Internal inspection in crankcase revealed conditions satisfactory (209-210a).

Oct. 16-21, 1967

Vessel at Bethlehem Steel Corporation, Hoboken, New Jersey, for annual drydocking. No work was required to be done to the bearings (180a; 678a-679a).

Oct. 22, 1967

Vessel called at Philadelphia.

Oct. 27-31, 1967

Vessel called at New Orleans.

Nov. 2-4, 1967

Vessel called at Houston. Internal inspection in crankcase revealed conditions satisfactory (213a-215a; 222a).

Nov. 6, 1967

Charles Allan, Hellenic's marine superintendent, sends letter to Chief Engineer in care of ship's agents at Philadelphia, enclosing ship's "file copy" of October 11, 1967 readings and closing with the statement "We will take further readings at the next available opportunity with the ship in both loaded and light conditions" (Ex. 26).

Nov. 8, 1967

Vessel called at Jacksonville.

Nov. 11-13, 1967

Vessel called at Philadelphia. Crankshaft alignment readings taken by Chief Engineer by wire gauge unavailable. Internal inspection in crankcase revealed conditions satisfactory (213a-215a; 222a).

Nov. 14-18, 1967

Vessel called at New York. Internal inspection in crankcase revealed conditions satisfactory (213a-215a; 222a).

Nov. 19, 1967

Vessel sailed from New York bound for Jeddah. During the course of the voyage up to the time of the fracture on December 24, the main engine was operating well (215a-217a; 233a).

Dec. 24, 1967

HELLENIC SAILOR'S No. 2 after side rod crankshaft web fractured when the vessel was in the Red Sea en route to Jeddah.

The Decision Below

As an aid to analysis, the District Court's decision may be divided into five parts:

(1) The Court's view of the applicable law;

(2) The Court's findings with respect to the cause of the crankshaft fracture on December 24, 1967;

(3) The Court's findings with respect to crankshaft wire alignment readings taken at New York on October 11, 1967, and the absence of one such reading taken at Philadelphia on November 13, 1967, leading to its conclusion that "[t]his situation alone would mean * * * that Hellenic Lines has not sustained its burden of proof of showing due diligence

with respect to the crankshaft prior to the vessel leaving for the Middle East on November 19th." (596a);

(4) The Court's findings with respect to the web deflection method of measuring crankshaft alignment, leading to its conclusion that Hellenic "failed to sustain its burden of proof in connection with its assertion that it did not need to take web deflection readings at or near the time the voyage in question commenced." (604a);

(5) The Court's findings, for purposes of appellate review, rejecting Cargo Underwriters' contentions that certain repairs undertaken in the first port of refuge, Port Sudan, in January, 1968 were improvident and were negligently carried out, causing further damage.

(1) *The Court's view of the applicable law*

The Court noted at the outset that the legal basis for cargo's obligation to contribute in general average rests in Clause 11 of Hellenic's bill of lading (the "new JASON clause") and 46 U.S.C. §1303(1) and §1304(1).* Correctly summarizing the interplay of contract and statute, the Court said: "If the crankshaft fracture is something for which Hellenic Lines would not be liable under COGSA,

---

* Title 46 U.S. Code §1303 provides:

"(1) The carrier shall be bound, before and at the beginning of the voyage, to exercise due diligence to—

(a) Make the ship seaworthy * * *."

Title 46 U.S. Code §1304 provides:

"(1) Neither the carrier nor the ship shall be liable for loss or damage arising or resulting from unseaworthiness unless caused by want of due diligence on the part of the carrier to make the ship seaworthy * * * in accordance with the provisions of paragraph (1) of section 1303 of this title. Whenever loss or damage has resulted from unseaworthiness, the burden of proving the exercise of due diligence shall be on the carrier or other persons claiming exemption under this section."

then it may recover general average in this case. But if the crankshaft failure is something for which Hellenic Lines would be liable under COGSA then it may not recover general average in this case." (584a).

Although the Court properly observed that §1304(1) places the burden of proving the exercise of due diligence on the carrier, the Court did not mention another effect of the statute—namely, that Hellenic would not be liable for unseaworthiness (the crankshaft fracture which manifested itself on December 24, 1967) unless the unseaworthy condition was proximately caused by want of due diligence.

In the Court's view "[t]he question to be resolved is whether Hellenic Lines has sustained its burden of proving that it exercised due diligence before and at the beginning of the voyage within the meaning of COGSA, Section 3(1) [46 U.S.C. §1303(1)]. I hold that Hellenic Lines has not done so". (584a).

The Court turned to what constituted "the beginning of the voyage" (584a). Noting that outbound cargo was loaded at Savannah, New Orleans, Houston, Jacksonville, and Philadelphia prior to the vessel's call at New York on November 14-19, 1967, the Court applied the "voyage in stages" doctrine. Because New York was the HELLENIC SAILOR's last port of call before sailing foreign and both Hellenic's general manager and Allan, its principal engineering officer, were in New York, the Court reasoned "that while the vessel was in New York it was under the control of the owner, rather than under the sole control of the master"; that "if, as to any cargo, the voyage had commenced at a prior port, it was effectively interrupted in New York when the vessel came under the owner's control"; and that "the owner had a diligence obligation at and prior to New York as to all cargo on this voyage, whether loaded in New York or not." (586a-587a).

The Court cited as authority for this proposition, *The ISIS*, 290 U.S. 333 (1933).

(2) *The Court's findings with respect to the cause of the crankshaft fracture*

The HELLENIC SAILOR became disabled on December 24, 1967 when the No. 2 after side rod crankshaft web fractured. The Court correctly observed that "[t]he fracture was found and manifested itself during the course of [the] voyage." (584a).

The Court found "as a fact that the fracture was the result of a fatigue crack occurring over some period of time, followed by a sudden rupture of the rest of the web at the time of the casualty" and that "this was all due to a bending stress on the web." (589a-590a). The Court further found that there was "no evidence that the fatigue crack started on any visible surface or was visible at or before" the HELLENIC SAILOR's departure from New York on November 19, 1967 (590a).

The Court compared the evidence of both sides on the subject of causation. Cargo Underwriters' witness testified "to the effect that the fracture of the web in question was a bending fracture resulting from excessive bending stress." (589a). Hellenic's evidence was "that the fracture was the result of a fatigue crack followed by a mechanical fracture, that is, a fatigue crack about one-third of the way through the web followed by a sudden fracture, or instantaneous fracture at the time of the casualty called a mechanical fracture." (589a). The Court concluded the parties' evidence was consistent: "A bending fracture can start with a fatigue crack." (589a).

The Court went on to find "that the probable cause of the fracture of the side rod web was the flexing of the nearby large crankshaft web, which transmitted a bending stress to the side rod web." (590a-591a; 601a).

(3) *The Court's findings with respect to crankshaft alignment readings taken by the wire alignment method over the years that Hellenic operated the HELLENIC SAILOR, including readings taken at New York on October 11, 1967, and the absence of one such reading taken at Philadelphia on November 13, 1967 (590a-601a)*

(a) The methods of measuring crankshaft alignment. (590a-592a).

The Court correctly stated that "shaft alignment in a ship under operating circumstances is never perfect, that is, it is never running perfectly around a horizontal axis" (590a) and that "the crankshaft of a vessel such as the HELLENIC SAILOR inevitably shows some sag or some hog." (590a). The Court here returned to its earlier discussion of causation, to relate the methods of measuring crankshaft alignment to "bending stress". It observed that "if a deflection from the true horizontal is too great, this deflection can cause a bending stress. For instance, an excessive sag will cause the large web in the cranks to flex in and out as the shaft turns. This will transmit a force through the connecting rod pin to the adjacent side rod web and will cause that web to bend back and forth." (590a).

The Court described how shaft alignment is measured. The Court acknowledged that use of a wire gauge was the "most common method of measuring crankshaft alignment on a vessel such as the HELLENIC SAILOR" (591a), but then referred to "[a]nother type of measurement which has been spoken of in the case * * * called web deflection measurement". (591a). Noting that "this is a measurement of how much the large webs in the cranks flex as they turn through their rotating cycle" (591a-592a), the Court offered its description of the method: "[T]o simply measure the distance between the two bottoms of the U, that is, the two large webs, the distance inside the U. This distance is

measured at four points in the turning cycle, and the differences in those measurements will measure the web deflection." (592a). [Presumably, the Court meant to say that the distance measured was the space between the two tops, *not* "bottoms", of the U formed by the two large center webs and the center crankpin.]

(b) The October 11 readings and the absence of November 13 readings (592a-599a)

The Court's primary holding in the case is found within these pages. It was based upon the following:

(i) The October 11 readings taken at New York (Exhibit 23);

(ii) Allan's letter of November 6, 1967 (Exhibit 26) addressed to the Chief Engineer in care of Hellenic's agents at Philadelphia which he received on the HELLENIC SAILOR's November 11-13 call there;

(iii) The absence of readings which the evidence showed were taken by the Chief Engineer on November 13; and

(iv) The deposition testimony of Allan who was not called as a witness by either side at trial.

The October 11 wire alignment readings were taken by Golten Marine on the vessel's inbound call at New York when the vessel had a light draft of 12 feet 6 inches forward and 22 feet 10 inches aft. They showed a sag of 32 thousandths of an inch at No. 2 main bearing, 42 thousandths of an inch at No. 3 main bearing and 32 thousandths of an inch at No. 4 main bearing (Exhibit 23).

The Court dictated into its decision Allan's November 6 letter in its entirety (593a). It noted Hellenic's argument "that little significance should be attributed to the statement in his letter that the October 11th figures show an

excess over the desirable measurements" (598a), but concluded: "I do not wish to give excessive significance to those words, but I do not believe I am doing so when I hold, as I do, that they indicate to me a judgment on the part of Mr. Allan that the October 11th readings were cause for concern from an operational standpoint". (598a).

The Court noted that, in reporting their October 11th readings to Petsis (Allan's assistant), Golten Marine said that "the readings were satisfactory and that no work on the crankshaft was needed." (592a). It further noted that Golten, the head of Golten Marine, a company with "long experience in measuring and repairing crankshafts" (601a), "testified at the trial that the October 11 readings were perfectly satisfactory", indeed "dream readings"; that Golten's service engineer, Haugestad, "has testified that these readings were satisfactory"; and that Smith, who was "retired from Sun Shipbuilding but had a long career at that company in connection with the building of engines and crankshafts" (601a), "also testified that they were within operational tolerances." (596a). Notwithstanding such testimony the Court was troubled "that there are no real objective operational tolerances against which to measure the readings which were taken." (596a).

After observing that "the question of how much sag or how much hog would be permitted was a matter for the sound judgment of the people responsible for the vessel" (596a-597a), the Court reverted to Allan's November 6 letter (Exhibit 26) and the absence of November 13 readings: "The record shows that the marine superintendent of Hellenic Lines, in his sound judgment, was concerned about the October 11 readings, both what they showed in terms of sag and whether they were, in fact, accurate" and "we have no information as to the results of the follow-up which the marine superintendent requested." (597a)

With respect to the "follow-up", the Court observed that the Chief Engineer took readings at Philadelphia on November 13 in response to Allan's November 6 letter, by which time "the vessel was closer to being fully loaded than it had been on October 11th." (594a). The Court noted that "on the present record there is no direct evidence whatever as to what the results were of the Philadelphia alignment readings or what those readings actually were." (595a). It noted that "[T]o compensate for this situation, plaintiff has introduced expert testimony, in the form of an opinion, that the readings taken in Philadelphia must have been the same as certain readings taken later after the crankshaft fracture had manifested itself." (595a). The Court, however, rejected "the opinion that the February 3rd readings can be taken to reflect any Philadelphia readings of November 13th" on the ground that Allan "testified in his deposition that the readings would not be the same, that the February 3rd readings would be different because of the fact that by that time the crankshaft fracture had manifested itself." (595a).

The Court summarized "the present record": "Readings were taken in New York on October 11th which the marine superintendent of Hellenic Lines stated were in excess over the desirable measurements, and which the marine superintendent believed were possibly inaccurate because of the problem with the ship's draft. The marine superintendent requested further readings. There is evidence that further readings were taken on November 13th. There is no evidence whatever as to what was found in those further readings, as to whether they indicated a dangerous condition, or what condition with respect to that ship and with respect to the October 11th readings." (596a).

The Court concluded that "this situation alone would mean * * * that Hellenic Lines has not sustained its burden

of proof of showing due diligence with respect to the crankshaft prior to the vessel leaving for the Middle East on November 19th." (596a).

(c) Trend

Proceeding from its inference that Allan's November 6 letter indicated a judgment on Allan's part that the October 11 readings were "cause for concern from an operational standpoint" (598a), the Court referred to a portion of Allan's deposition (730a-731a) where he was asked to comment on a range in the sag at the HELLENIC SAILOR's No. 3 bearing shown on February 1, 1966 (Exhibit N), August 2, 1966 (Exhibit P) and October 11, 1967 (Exhibit 23). The Court observed that "although Mr. Allan's deposition at this point is a little difficult to interpret, upon some study I believe that it clearly states that in his view this range is unacceptable." (599a). This led the Court to discuss "the subject of the trend of alignment readings taken over a period of years on the HELLENIC SAILOR." (599a).

Noting that the HELLENIC SAILOR's main bearings were renewed in the fall of 1962, the Court reviewed the record of wire alignment readings since that time to October 11, 1967. Readings were taken on November 20, 1963 (Exhibit L); September 8, 1964 (Exhibit M); February 1, 1966 (Exhibit N); August 2, 1966 (Exhibit P) and October 11, 1967 (Exhibit 23) (599a-600a). The Court noted that "the web which fractured in this case was immediately forward of the No. 3 main bearing" and thus "at the greatest point of sag according to the October 11, 1967 reading." (592a). It therefore referred to the readings at the No. 3 bearings, the maximum point of sag; it did not discuss the relationship of these readings to the readings taken at Nos. 2 and 4 bearings which were an integral part of any determination of the alignment of the entire crankshaft.

Turning to the comment of Cargo Underwriters' expert "that there is a trend shown by these readings to a greater and greater sag, and that this trend should have been sufficient to cause concern" (600a), the Court termed the expert's views "reasonable" and deemed it "clearly reasonable to consider the entire trend and not rely solely on the isolated October 11, 1967 reading." (600a).

(4) *The Court's findings with respect to the web deflection method and the absence of any such readings since September, 1962 (601a-604a)*

The Court's secondary holding was that Hellenic "failed to sustain its burden of proof in connection with its assertion that it did not need to take web deflection readings at or near the time the voyage in question commenced." (604a).

The Court commenced its discussion of web deflection measurement by a restatement of its view that "the probable, if not the certain cause of the fracture of the side web in question was the flexing of the adjacent large web which created a bending stress." (601a). The Court noted at this point that the HELLENIC SAILOR's engine was of the Doxford type and that Hellenic's experts "all testified at the trial to the effect that web deflection readings are not taken in an engine of this type." (601a).

Nevertheless, the Court concluded that "there are two possible uses for a web deflection reading. One use would be to use the web deflection reading in order to measure crankshaft alignment. Another possible use for a web deflection reading is to measure web deflection for its own sake without converting it, or converting such measurement into figures for the hog and sag of the crankshaft as a whole." (602a). The Court thought that there might be "some possible ambiguity" in the testimony of Hellenic's experts and that they possibly "did not mean to say that a web deflection

reading would be of no use in order to determine web deflection for its own sake." (602a)

The Court summarized the thrust of the experts' testimony that Hellenic urged upon the Court: "[t]hat web deflection readings on a Sun Doxford engine are not necessary or useful for any purpose, and that all the necessary, meaningful information can be obtained from a wire gauge reading of crankshaft alignment; and that whatever needs to be known about web deflection can be derived from such wire gauge readings." (602a).

The Court then expressed three general problems it had with this position. First, "in connection with bending stresses, the matter of web deflection as an independent measurement, apart from crankshaft alignment, is in and of itself a matter of prime concern, because the web deflection is the thing which sets up the bending moment on the adjacent parts, such as the small web which cracked in this case." (603a). Second, the Court referred to Allan's deposition testimony "that web deflection readings in and of themselves are essential", "that the purpose of these readings is to insure that the deflection of the webs is not too great due to possible misalignment", "that on the Hellenic Line's vessels, the chief engineers of such vessels took web deflection readings almost every voyage", "that they would be recorded and records kept on the vessel", and "that he would not learn of the results of the web deflection readings unless there was something abnormal." (603a).

And, finally, the Court adverted to a letter from Sun Shipbuilding in Chester, Pennsylvania to the American Bureau of Shipping in Piraeus dated September 14, 1960 (Exhibit K), which Hellenic stipulated at trial came from its engineering files. Referring to a diagram annexed to the letter, the Court said it showed "a schematic clearly indicating how to take web deflection measurements and giving recommended tolerances for such web deflections." (604a).

Noting that web deflection readings taken on the HELLENIC SAILOR on October 31, 1960 (Exhibit V, first sheet), November 23, 1960 (Exhibit V, second sheet) and September, 1962 (Exhibit E, sheet four) were the only web deflection readings introduced into evidence, the Court concluded that Hellenic had not "satisfactorily explained the absence of any specific information regarding such readings or the results thereof following September 1962, a time some five years before the casualty in question." (604a).

(5) ***The Court's findings in favor of Hellenic with respect to Cargo Underwriters' contentions that repairs undertaken in the first port of refuge, Port Sudan, were "improvident and were negligently carried out, causing further damage." (604a-608a)***

The Court's holding that Hellenic failed to prove the exercise of due diligence prior to breaking ground at New York on November 19, 1967 made academic Cargo Underwriters' contentions with respect to efforts to repair the fractured crankshaft at Port Sudan in January, 1968. For purposes of appellate review, however, the Court made certain findings (604a-607a) and ruled that "in the event Hellenic Lines were to be found on appeal to be entitled to general average and to have exercised due diligence prior to the departure from New York, I would hold that it would be entitled to whatever general average would be due without recognizing the contentions of the defendants as to improvident and negligent repairs." (608a)

The evidence related to two kinds of repair. Allan proposed a clamp-like device, called a "strong back", intended to hold the fractured No. 2 crankshaft section together while the HELLENIC SAILOR proceeded at slow speed on the Nos. 1, 3 and 4 cylinders to a port where permanent repairs could be effected. On the other hand, Hellenic's general manager was advised by Van Cooten, a metal repair expert, "that the

strong back repair presented serious dangers to the safety of the vessel" (605a) and that a metal lock repair should be undertaken. The Court found that Hellenic's general manager "exercised a judgment that the strong back repair should not be undertaken, and that the metal lock repair should be" and that "it was a reasonable judgment." (606a). In addition to finding "that the decisions regarding repairs taken by the general manager of Hellenic Lines were reasonable" (607a), the Court found that there was "insufficient proof of any negligence in the course of the repairs by Mr. Van Cooten or otherwise and that a crack was found in the No. 3 journal "had accompanied the crack in the [after side rod] web, rather than being caused by Mr. Van Cooten's work or any other repair work at Port Sudan." (607a)

POINT I

The District Judge either did not understand, or disregarded, the physical fact that alignment of the HELLENIC SAILOR's crankshaft was directly controlled by the condition of the main bearings, and that the condition of the main bearings and resultant crankshaft alignment were in all respects satisfactory both prior and subsequent to the fracture which occurred on December 24, 1967.

The Court erred not in its findings of fact based on the evidence, but in the inferences which it drew from the evidence—inferences which can as well be drawn by this Court.

The October 11, 1967 readings at New York

Golten Marine was, in the Court's words, the company "of long experience in measuring and repairing crankshafts" (601a) which Hellenic employed for many years

to check crankshaft alignment at the Port of New York (288a). Lloyds', the HELLENIC SAILOR's classification society, had no requirement that crankshaft alignment be checked by any method (731a). Nevertheless, Golten Marine would be called upon to check crankshaft alignment by wire gauge, on each of Hellenic's Doxford vessels at New York, about once a year "if nothing else serious happened" (323a; 176a-177a), and Mr. Golten, the head of Golten Marine, testified that his company never had "any call as often from any other shipowner as we have from Hellenic Line when it comes to crankshaft readings" (323a). Golten Marine was performing services for vessels owned and operated by Hellenic since 1950 (288a).

The October 11 wire gauge readings by Golten Marine were a "routine inspection" (177a), performed while the HELLENIC SAILOR was at Hellenic's Brooklyn Terminal, discharging the balance of her inbound cargo before proceeding to Bethlehem's facilities at Hoboken for her annual drydocking (180a).

As the Court noted, it was Petsis who received a verbal report of the readings from Golten's representative soon after they were taken (592a) and both men considered the readings were satisfactory and not indicative of any need for work (177a-179a). Golten's representative agreed with Petsis that the bearings were in order (177a-178a). The Chief Engineer was physically present in the crank case when the readings of October 11 were taken, and considered that the readings were satisfactory and that no work was required on the bearings (209a-212a).

The October 11 readings were taken with the vessel's draft at 12 feet 6 inches forward and 22 feet 10 inches aft (Exh. 23). This wire gauge reading showed the crankshaft lying with a sag of 32 thousandths of an inch at No. 2 main bearing, 42 thousandths of an inch at No. 3 main bearing

and 32 thousandths of an inch at No. 4 main bearing, which was to be expected in the vessel's light condition. And they showed the shaft to be lying in the bearings in a smooth curve, with the maximum point of sag in the center of the shaft at No. 3 bearing, as desirable. The maximum sag of 42 thousandths of an inch at the No. 3 bearing was well within Haugestad's 60 thousandths of an inch maximum.

Golten himself testified at trial that the October 11 reading was a "dream reading", "[t]hat it is so good that if I should get it any better it would take me probably days to get it any better", and that if the HELLENIC SAILOR were his ship, he would be "happy to see a reading like this" (288a-289a). Haugestad confirmed that in his judgment the October 11 readings reflected "satisfactory shaft alignment" (440a-441a).

Petsis [Allan's assistant] was in attendance during the October 16-21 drydocking and no work was required to be done to the bearings (180a). The October 11 soundings were taken on the first day of a ten-day call, whose major purpose was attending to the vessel's mechanical requirements. If, on October 11, the crankshaft required realignment, the bearings would have been sent ashore to Golten Marine's plant in Brooklyn for remetalling but this was unnecessary (174a-178a; 209a-212a).

Allan was, of course, present in New York on October 11, 1967 when the readings were taken and until October 16 when he went on vacation. He returned to the office on October 31 and was in New York and present during the HELLENIC SAILOR's outbound call in November.

A fair reading of Allan's entire deposition testimony demonstrates why he wrote the November 6 letter (Exh. 26), which the Court, after hearing only plaintiff's first witness, called "the guts of the case" (202a). Allan said

he wrote the November 6 letter as a "covering letter" to the Chief Engineer enclosing the actual chart of the alignment readings (Exh. 23) "which was the usual procedure" (712a). He testified that what he was concerned about when he wrote the letter was the vessel's draft at the time of the October 11 readings (713a). He at no point suggested the readings were "cause for concern from an operational standpoint", as the Court concluded in its opinion (598a). Nor did the letter itself, by its terms, evince any such concern on the part of Allan.

His concern was that by reason of the draft difference fore and aft, a difference of some 10 feet, further readings would be "more indicative of what would be required for correction" (684a). Indeed, although the Court was unable to grasp the point, the plain fact is that the readings taken at Port Sudan in February, 1968, fully confirmed that no correction of the shaft alignment had been, or was, necessary or desirable. As Allan himself testified "had there been any appreciable wear shown by the bearings, naturally the bearings would have been removed and re-metalled" during the October, 1967, drydocking (678a-679a).

The February 3, 1968 readings at Port Sudan

The HELLENIC SAILOR sailed fully loaded from New York for the Red Sea on November 19, 1967. Her draft on sailing was 26 feet 2 inches forward and 31 feet aft (230a). As she approached full load, the sag shown on the October 11 readings (Exh. 23) would be expected to decrease (442a). The vessel's draft when the February 3 readings were taken was 24 feet forward and 29 feet aft.

To put the Port Sudan readings (Exhs. 36 and 39) into proper perspective, the HELLENIC SAILOR was towed to Port Sudan arriving there about December 29, 1967. Allan flew

to Port Sudan and boarded the vessel on January 2, 1968. He had devised a plan to effect a temporary repair by clamping the fractured web together and running the vessel on three out of four cylinders. Hellenic's General Manager instructed Allan to abandon these repairs on January 7. On January 16, Van Cooten, the metal repair specialist, arrived at Port Sudan and boarded the ship (529a).

Van Cooten's method of mending the shaft involved a process of locking the two halves of the fractured web which would allow the vessel to proceed on her voyage on all four cylinders. His work continued until February 1, 1968, by which time his contemplated repair was 95% complete (529a). Allan and a Lloyds' surveyor were in attendance (521a). On February 1, Van Cooten's repair was abandoned because he found a further crack in the No. 3 journal. At this time, the fractured web was completely locked together and what Van Cooten was doing was closing the crack [with weld] where there was a "feeling that there may be an oil leak" (532a-533a).

Meanwhile, at Allan's request, Haugestad came to Port Sudan to check the crankshaft alignment by the "more accurate" telescopic method (278a), which could be used as the vessel was lying at anchor with her machinery dead (657a).

The District Court never understood Haugestad's testimony (430a-440a). Haugestad's readings, taken February 3-4 (Exhs. 36 and 39), reflect three readings. One reading (Exh. 36), taken at one of the four crankshaft positions, from which the telescope could be sighted down the length of the crankshaft between the connecting rods, showed a sag of 17 thousandths of an inch at No. 2 bearing, 26 thousandths of an inch at No. 3 bearing and 16 thousandths of an inch at No. 4 bearing. Exhibit 39 depicted two

readings taken with the crankshaft at a second position. At the time of Haugestad's February 3 readings the connecting rods at No. 2 cylinder were disconnected from the No. 2 crankshaft section. Haugestad testified as to how he "more than compensated" for this in taking one of his readings. One reading shown by a solid line reflected how the crankshaft was lying without the pressure of the 15-ton weight of the disconnected connecting rods on the No. 2 crank section. These readings showed a sag of 15 thousandths of an inch at No. 2 bearing, 16 thousandths of an inch at No. 3 bearing and 19 thousandths of an inch at No. 4 bearing. The other reading depicted on Exhibit 39 with a dotted line was taken after the Nos. 2 and 3 bearing caps had been pressed and bolted down tight on the journals so as to eliminate the spherical and lubricating clearances and compensate for the weight of the No. 2 connecting rods that had been disconnected. These readings showed a sag of 21 thousandths of an inch at No. 2 bearing, 21 thousandths of an inch at No. 3 bearing, and 20 thousandths of an inch at No. 4 bearing. Allan explained that the purpose of "pulling the shaft down tight" at Nos. 2 and 3 bearings was "to see if all the bearings in the shells themselves were in perfect alignment" and that he considered the alignment "almost perfect" (757a). Haugestad characterized the readings as "very good", reflecting "satisfactory alignment". Haugestad explained that these readings "should be within a few thousandths" of readings of shaft alignment had they been taken at New York in November, 1967. Asked if anything might have happened to the HELLENIC SAILOR's crankshaft between the October 11th and February 3rd readings to adversely affect the crankshaft, he stated: "I can't see what could have happened. This is a normal difference between a light and a loaded ship, the difference between that is

between October and February" (442a). And in response to the question what would be expected to happen to the readings of October 11 during the normal course of events as the vessel proceeded to load cargo, he said "Well, it is perfectly clear what happened. She got loaded and she straightened out somewhat. To a better alignment"—"which would come from loading in the forward and aft holds" (442a). This evidence was not, as the Court suggested, just theoretical opinions of experts based on suppositious hypothetical facts. It was the eyewitness testimony of witnesses who had known this vessel's crankshaft for years and, moreover, the physical facts demonstrate that the readings at Port Sudan reflect, with reasonable accuracy, the shaft's alignment on sailing from New York.

But the Court rejected "the opinion that the February 3 readings can be taken to reflect any [missing] Philadelphia readings of November 13" on the ground that Allan "has testified in his deposition that the readings would not be the same, that the February 3 readings would be different because of the fact that by that time the crankshaft fracture manifested itself" (595a). The Court misread Allan's deposition. Allan was asked whether the February 3 Port Sudan readings "reflect the alignment of the HELLENIC SAILOR's crankshaft when she sailed from New York in November, 1967." He said it would not "because the shaft was lying in a different position after the web fracture" (655a-656a). The Court neglected the evidence that Van Cooten's metal lock repairs were complete for all practical purposes by February 1 when they were abandoned, and that the February 3 readings were readings of an intact crankshaft. In doing so the Court missed the point—that upon departure from New York on November

19* (and from Philadelphia on November 14**) the HELLENIC SAILOR had a deeper draft, thus less sag in her crankshaft, and thus better alignment, than the October 11 readings. As Haugestad testified, had readings been taken at New York in November they should have been "within a few thousandths" of the Port Sudan readings, which were satisfactory or, as Allan himself said, showed "almost perfect" alignment (657a). The Lloyds' surveyor who attended the HELLENIC SAILOR at Port Sudan from January 24 to February 6, 1968 issued his report which stated in part "Crankshaft alignment was checked and readings were satisfactory as shown on the attached two sheets" (Exh. 65), and the two sheets attached to the surveyor's report were Haugestad's February 3 readings (Exhs. 36 and 39).

"Puzzled" by Haugestad's firm assurances that his February 3rd reading would "likely" be the same as the reading upon leaving New York and not affected by the fracture or "crack" in the web (450a), the judge showed his own preconception of the situation and added to his own confusion by confronting the witness with a "photo of the fractured web" (Defendants' Exh. B) showing the web in two pieces (458a). Admitting that he did "not know where this was taken", the judge asked the witness whether the photo showed the condition "when you saw it", and "when you were there taking your February 3rd readings". The witness responded firmly that "the shaft was intact. Except for the crack" (458a). And although the witness had earlier stated on cross that "the crack was hardly visible" (450a),

---

* Draft on sailing New York was 26 feet 2 inches forward and 31 feet aft (230a).

** Draft on sailing Philadelphia (Paulsboro) was 25 feet 3 inches forward and 29 feet 1 inch aft (228a).

the Court pressed him to say "how big the crack was" (459a), until the witness finally said he could not remember (459a).

The plain truth is that the photograph used by the Court, though produced by defendants' counsel (Defendant's Exh. B), had never been properly identified by anyone in respect to when, where and by whom it was taken. One thing certain, however, is that it did not portray the web, as it was, at Port Sudan, either on February 3-4, 1968 or before that date. Whatever misconceptions the judge had on that score should have been laid to rest by Van Cooten's testimony as to the crack and his repair work during January up to February 1, 1968 (513a-575a), together with related photographs (Exhs. 40-43; 45-49; 52; 52A; 52B), but the Court, in his decision, still adhered to his previously-formed notions that the February 3-4, 1968 readings could not reflect what the readings would have been on leaving New York. Note, incidentally, that in all the confusion, Haugestad forgot that the crack in the intact web had been closed by Van Cooten before February 3rd, as had also Allan, in his deposition testimony (656a) that the Court used in his decision to justify his refusal to accept the February 3rd readings as reflecting the shaft's alignment on the vessel's departure from New York.

If the fracture on December 24 had been due to misalignment of the crankshaft, there would have been damage to the foundation of the engine (464a), let alone the bearings which was not the case. There was no damage to the vessel other than the fractured web.

The "Trend" theory

In response to a long hypothetical question from defense counsel (396a-399a), Cargo Underwriters' expert, Bates, gave his opinion that it would have been "prudent" to take web deflection readings on October 11, 1967 when the wire

gauge readings were taken by Golten Marine in New York (399a). The hypothetical question included a recitation of crankshaft alignment readings taken by wire gauge together with the HELLENIC SAILOR's draft on the following dates: November 20, 1963 [Exhibit L]; September 8, 1964 [Exhibit M]; February 1, 1966 [Exhibit N]; August 2, 1966 [Exhibit P] and October 11, 1967 [Exhibit 23]. All were taken by Golten Marine and all were taken at New York.

Bates' opinion was solicited not with respect to the wire gauge readings themselves but as to web deflection readings. He reasoned it would have been prudent to take web deflection readings on October 11, 1967 "[B]ecause you have these figures laid out in a way that you have introduced them, you can see immediately that there is a continually increasing sag from 1962 to 1967." (399a).

The Court drew on this "trend" to buttress its primary holding (599a-601a) and observed "it is clearly reasonable to consider the entire trend and not rely solely on the isolated October 11, 1967 reading" (600a). Clearly Hellenic never did. Wire gauge readings show how the crankshaft is lying in the bearings, and if the sag is excessive or if the readings show a dog-leg, the readings would reveal whether the crankshaft required realignment which would be accomplished by remetalling the bearings. The difficulty with the "trend" theory is in solely considering the readings at the No. 3 bearing, as both the Court and Cargo Underwriters' expert did, without relation to the readings at the Nos. 2 and 4 bearings and thus the alignment of the crankshaft as a whole. From November, 1962 when new bearings were flown to Port Sudan and installed in the HELLENIC SAILOR, through February, 1968 when she was again at Port Sudan, the wire gauge readings taken by Golten Marine all showed satisfactory crankshaft alignment and that no remetalling of the bearings was necessary.

POINT II

The District Judge erred in holding that due diligence required the taking of web deflection readings on a Sun-Doxford engine, or that such readings would serve any purpose other than indicating alignment.

The District Court's second holding of Hellenic's failure to sustain its burden of proving due diligence is based upon a finding that "web deflection readings in and of themselves are essential", and that they constitute "an independent measurement, apart from crankshaft alignment" (603a).

There is no support in the record for such a proposition, the trial court misunderstood the testimony concerning this type of measurement, and the error is evident not only from the testimony of both Allan and Bates, but from the Court's own summary of Allan's testimony, in which the Court describes Allan as testifying that the purpose of web deflection readings "is to insure that the deflection of the webs is not too great *due to possible misalignment*" (603a).

The District Court itself took over the questioning of Bates on this point. Bates was asked to assume that web deflection measurements between the center crank webs revealed excessive deflection. Bates was asked to advise the Court of what could cause excessive web deflection and his reply was "misalignment of the main bearings" and "uneven wear-down of the main bearings" (405a). Such conditions, inevitably, could only be corrected by remetalling and remachining the bearings.

POINT III

Nonperformance of a particular test at or before the commencement of a voyage does not constitute a want of due diligence to make the vessel seaworthy, if performance of the test would not have revealed the unseaworthy condition which resulted in the casualty.

"Due diligence" means no more than "reasonable care". In *The Southwark,* 191 U.S. 1 (1903), the Supreme Court said:

> "The burden was upon the owner to show by making *proper and reasonable* tests that the vessel was seaworthy and in a fit condition to receive and transport the cargo . . . ." (pp. 15-16; italics ours.)

In *Peter Paul, Inc.* v. *Rederi A/B Pulp,* 2 Cir., 258 F.2d 901 (1958), this Court said:

> "On this phase of the case, all the ship owner need establish is that *normal* precautions were taken to see that a discoverable notch did not exist." (pp. 905-6; italics ours.)

In *The Hamildoc,* 1950 A.M.C. 1973 (Court of Appeals, Quebec), the court said:

> "Due diligence means doing everything reasonable, not everything possible. The term is practically synonymous with reasonable or ordinary care." (p. 1985)

Hindsight is *not* the test of due diligence. In *The Germanic,* 196 U.S. 589 (1905), the Court said:

> "It is quite true that negligence must be determined upon the facts as they appear at the time and not by

> a judgment from actual consequences which then were not to be apprehended by a prudent and competent man." (pp. 595-6)

In *Standard Oil Co.* v. *Anglo-Mexican Petroleum Corporation,* 112 F. Supp. 630 (S.D.N.Y. 1953), the court stated:

> "But clearly, wisdom born of the event cannot be the measure of due diligence, and the standard must be one of conduct rather than of consequences." (pp. 636-7)

In the case at bar, Hellenic, as part of a regular and diligent program of inspection and testing, and in conjunction with the annual drydocking of the vessel immediately preceding the voyage in question, caused an independent expert to conduct a wire gauge alignment reading of the crankshaft, the results of which were by all accounts satisfactory and on the basis of which the independent expert expressly advised Hellenic's engineering representative that the crankshaft and bearings were in order (178a).

Nevertheless, and notwithstanding that no testimony takes exception to the test in question (which is generally conducted only on an *annual* basis [176a; 323a]), defendants seek to undermine Hellenic's exercise of due diligence by contending variously that (a) an additional wire gauge alignment reading should have been taken as a precondition to the vessel embarking on its ensuing voyage, and (b) Hellenic ought to have taken a "web deflection" reading prior to embarking on the voyage. Defendants argue, and the trial court held, that Hellenic's failure to produce the results of any such tests raised an inference of want of due diligence.

The sole basis for the contention that a further wire alignment reading should be taken so soon after the highly favorable October 11, 1967 reading is Allan's November 6

covering letter to the vessel at Philadelphia stating that "We will take further readings at the next available opportunity with the ship in both loaded and light condition." Aside from the fact that the marine superintendent's letter does not constitute a "request" for further readings, as stated by the court (596a), it is clear that even if it were a request it was not one with which the superintendent did or could require compliance prior to prosecution of the voyage then in progress (the letter being addressed to the vessel at Philadelphia, the port preceding her final loading port of New York), since a reading with the vessel in "light condition", and the desired comparison, could not be made until she discharged her cargo at Calcutta.

Moreover, the actual examination both of alignment and of the bearings soon after the casualty showed them to be in all respects proper. In short, the inference of lack of due diligence is, at the least, overcome by evidence that the actual condition, in respect of which the test was or should have been conducted, was acceptable.

Secondly, the court turns to another test for the same *alignment* condition—"web deflection" measurements—and, because the fracture in question happened to occur in a *web* segment of the crankshaft, the court finds that there is an inference of lack of due diligence because of Hellenic's failure to produce evidence of "web deflection" readings which were made from time to time by the crew.

In so finding, the Court misunderstood the consistent testimony to the effect that "web deflection" measurements are simply a function of, and another indication of, *alignment,* are tested solely as evidence of the alignment of the shaft which in turn is a function of the condition of the bearings, and that such tests are not relied upon on Sun-Doxford engines since the greater flexibility of the crankshaft, in the unique and specially designed spherical bear-

ings of the Sun-Doxford, render the resulting greater range of web deflections non-indicative of the only condition under study: alignment of the shaft and condition of the bearings. For that reason, more precise and reliable methods of determining alignment are utilized on Sun-Doxfords (e.g., wire gauge readings), and web deflection tests are not relied upon, although they may be taken from time to time as another test of possible misalignment. In fact, and once again, the actual proof of the acceptability of the actual condition which the "web deflection" test is used to determine—shaft alignment and condition of the supporting bearings—overcomes any adverse inference that might arise by reason of the absence of the results of the occasional web deflection measurements.

As to both tests in respect of which the Court drew inferences adverse to Hellenic by reason of non-production of their results, it is clear that performance of the tests in question and the production of their results would not have revealed the unseaworthy condition which resulted in the casualty and therefore such tests cannot be deemed a prerequisite to due diligence in this regard.

In *The Toledo,* 30 F. Supp. 93 (E.D.N.Y. 1939), *aff'd,* 2 Cir. 122 F.2d 255 (1941), itself a fractured-crankshaft-web case, Campbell, J. said:

> ". . . the fracture was not discoverable before the vessel was delivered to the charterer, or before loading started in Philadelphia, by any test which would ordinarily or customarily be made, and that is all that is required to show due diligence by the shipowners." (p. 99)

Neither of the further tests urged by defendants, and held to be a prerequisite to due diligence by the trial court, would have discovered anything more than alignment as a function of the condition of the bearings, a condition which was

conclusively demonstrated both on October 11 and February 3 to be, by all accounts, satisfactory.

The disconnected charges of readings not produced or tests not made are at most " 'proof of negligence in the air', and this is not in law negligence" *The Chester Valley*, 5 Cir. 1940, 110 F.2d 592, 593.

POINT IV

Hellenic having exercised due diligence in respect of the crankshaft at and before the commencement of the voyage, the ensuing web fracture was caused by a "latent defect not discoverable by due diligence" and Hellenic is entitled to general average contributions in connection therewith.

As noted, Hellenic is obligated to do what is reasonable—not everything possible—in preparation for a voyage. Allan's November 6 letter does not remotely imply any limitation or condition on the vessel's ability prudently to depart on her imminent voyage from New York.

Hellenic's attention to a program of regular inspection and testing, with tests conducted by independent experts, conveys a clear and detailed picture of a diligent and careful shipowner. Specific tests were conducted and the crankshaft was passed shortly before the voyage in question. Other expert testimony on the trial supported the conclusion of the experts who were called to make the tests and pass on their acceptability, and Cargo Underwriters' expert in no way faulted the results of the October 11 wire gauge reading. Indeed, had a jury of experts been called upon to review the results of this routine test of the Sun-Doxford crankshaft at this time (a test which is generally conducted on an annual basis), it would have advised Hellenic that the crankshaft was suitable for the intended voyage.

That being the case, and the cause of the casualty therefore not susceptible of discovery by the steps normally taken by a reasonably prudent shipowner, the casualty in question comes within § 1304(2)(p) of the Carriage of Goods by Sea Act, 1936, as amended:

"Latent defects not discoverable by due diligence".

See, *Peter Paul, Inc.* v. *Rederi A/B Pulp*, 2 Cir., 258 F.2d 901 (1958).

CONCLUSION

The judgments appealed from should be reversed with directions to enter judgment in favor of Hellenic on both complaints.

Dated: New York, New York
April 7, 1975

Respectfully submitted,

BURLINGHAM UNDERWOOD & LORD
25 Broadway
New York, New York 10004
Attorneys for Hellenic Lines Limited,
Plaintiff-Appellant

HERVEY C. ALLEN
JOHN S. ROGERS
ALEXANDER S. KRITZALIS
Of Counsel

Service of ~~three~~ Two (2) copies of the within Brief is admitted this 7th day of April 1975

Haight Gardner Poor & Havens (?) — handwritten signature, partly illegible

x [illegible]

COPY RECEIVED

APR 7 1975

HILL, RIVKINS, CAREY, LOESBERG & O'NEILL

RECORD PRESS, INC., 95 MORTON ST., NEW YORK, N. Y. 10014—(212) [illegible]